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PROVISIONAL APPLICATION FOR PATENT COVER SHEET

This is a request for filing a PROVISIONAL APPLICATION FOR PATENT under 37 CFR 1.53 (c).

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☒ *Additional inventors are being named on the 2nd separately numbered sheets attached hereto*

TITLE OF THE INVENTION (500 characters max)

MULTIMEDIA CARD WITH MEMORY AND DECODER

JC857 U.S. PTO 60/471151 05/16/03

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ENCLOSED APPLICATION PARTS *(check all that apply)*

☒ Specification *Number of Pages* 15 ☐ CD(s), Number

☐ Drawing(s) *Number of Sheets* ☐ Other (specify)

☐ Application Data Sheet. See 37 CFR 1.76

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☒ Applicant claims small entity status. See 37 CFR 1.27.

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☒ No.

☐ Yes, the name of the U.S. Government agency and the Government contract number are: _____.

Respectfully submitted,

SIGNATURE _____ Date May 16, 2003

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PROVISIONAL APPLICATION COVER SHEET

Additional Page

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Docket Number	2233-1-2

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PROVISIONAL PATENT APPLICATION - CERTIFICATE OF MAILING

Inventors: Robert Widergren; Paul Germeraad; John L. Douglas; Edmond Sisler

Title of Invention: MULTIMEDIA CARD WITH MEMORY AND DECODER

Attorney Dkt. No.: 2233-1-2

CERTIFICATE OF MAILING OR TRANSMISSION

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MULTIMEDIA CARD WITH MEMORY AND DECODER

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FIELD OF INVENTION

A solid state memory card with compressed audio or video content and a compatible decompression program on the same physical device.

BACKGROUND

Multimedia card (MMC) devices are well known today as they contain multimedia stored memory content (MMC Stored Memory Content) for storing information of interest to the user. These are used in digital cameras for storing pictures and cell phones for loading low resolution games. The disadvantage of today's MMC devices is that they rely on the software for the processor (decoder / expander) of the content they contain to be in the memory of the hardware device on which they are attached. This means that the hardware device must have sufficicnt memory to

retain the decoding software. It also means that the hardware device must have a decoder program capable of decoding the particular encoding format of the content in a particular MMC device. These constraints on the hardware device work perfectly well for the originally intended applications but are insufficient for new applications that an MMC device can be used for.

SUMMARY OF THE INVENTION

The present invention provides a new advanced MMC device (AMMC device) in which a content decoder program is placed on the AMMC device and the decoder program corresponds to the compressed (encoded) format of the content stored in the MMC device's memory. Placing the decoder program in the MMC card is useful for providing additional levels of security for the content stored on the AMMC device as well as adding capability to decode the content stored on the AMMC device with decoders other than those that are today available on cell phones, hand held video game devices, and other processor limited hardware devices by providing to the hardware system a decoder program that is improved and more efficient than the original decoder program loaded on the hardware. Additional advantages of the invention will be understood in view of the present disclosure.

A hardware device in accordance with the present invention comprises both a decoder program and audio or video content on the same MMC (multi-media card). Today the hardware and software industries rely on a MMC card decoder program to be in the hardware or somewhere other than with the data.

The disclosed advanced multi-media card (AMMC) decoder program works on many different hardware playing devices equipped to display

visual and/or auditory information. To do this, the AMMC decoder program works with all commercially available operating systems. For example these principal operating systems today comprise Palm OS, Microsoft Pocket PC, Symbian, and Linux. The AMMC device has only one content file in its memory, but it has an AMMC decoder program for each operating system or it has one AMMC decoder program for any operating system with several unique interfaces, one for each operating system.

The AMMC device of the present invention is useful because it is a standard physical form factor used in many hardware devices such as cell phones, personal digital assistant devices, cameras, etc. The AMMC device of the present invention is further useful because it is a universally accepted input device. That is, it uses the standard electronic form factor. Hardware devices such as cell phones, personal digital assistant devices, cameras, etc. are capable of reading the data off of these cards because there exists an industry input/output standard. The standard today is called the MMC form factor specified by the MMC association.

Another useful aspect of the invention is that the video or audio decoding algorithm supplied with the content may be an improved version that is less complex and processes information faster with higher throughput than the algorithms found on the existing hardware devices themselves (the originally installed decoder). The AMMC supplied algorithm may have a higher video throughput than the existing hardware algorithm. With the invented system, customers can always have the latest, highest throughput capability along with the newest content.

The present invention uses the standard MMC controller circuit which is on the card to limit the number of times that the card content can be written. MMC controller circuits may be implemented as a

microprocessor with instructions or as a hard-wired state machine. This circuit is useful because the applications envisioned for AMMC devices involve multiple read cycles in the many thousands or millions, but only write cycles of one to one hundred times.

The present invention combines a AMMC device with a controller program or circuit that allows only a limited number of write operations with a memory chip otherwise considered defective because it can only accept a limited number of write cycles. The feature of the AMMC card device controller that allows more than one write operation is particularly useful to video and audio content vendors. For example, in the music business, when some audio, or alternatively video cards don't sell, they can be returned from the distributor or retailer for re-loading of the content and decoder with an alternative, preferably a newer, more saleable, set of audio or video tracks with decoder. For these cards returned for reprocessing, the controller program can be used to put a different, likely newer song or video on the same card. This reprocessing and reloading of additional and / or essentially different content and decoder allows vendors and distributors to reuse the AMMC devices to lower their costs, improving their profitability.

This feature of an AMMC card device controller that allows only a limited number of write operations is further useful because a limited write capability is part of the digital rights management strategy of industries such as music, video, gaming, etc. Compliance with the digital rights management strategy of these industries is accomplished by placing a third software component on the card. This software is called Content Protection Software (CPS). It is placed on the AMMC device so people can not easily copy the AMMC device's content in a first AMMC device to a second MMC or AMMC device and have it play correctly from the second MMC or AMMC device.

One function of the CPS (content protection software) is that it is self-enabled to detect that it has been placed on a flash memory card (a card capable of multiple writes). When this state is detected by the CPS code, the CPS code interacts with the content decoder program such that the AMMC device content is prevented from playing on the hardware device.

Because the decoder program is stored in the program memory of the playback device during operation, it usually disappears when the decoding process is terminated/completed. The hardware device operating system puts the used program memory back into a scratch pool on completion. As such, the AMMC device decoder and / or controller is not accessible to all but the most sophisticated programmers for copying. This feature is useful and advantageous in that it makes consumer pirating of the content difficult.

Another aspect of the invention used to for digital rights management takes advantage of the fact that the manufacture's code is put on the AMMC device card during manufacture (masking). During the decoding operation, the CPS program causes the host proccssor to read this code. If the code on the AMMC or MMC card does not correspond to the code for the AMMC content and the AMMC decoder program, thc CPS program does not enable the AMMC decoder program. Even though it may be executed, if not enabled, the content decoder will not decode the content. Because the CPS program will also be copicd by any such copying and will be executed on any hardware that attempts to play the copied card, this prevents content copied to another card from being played.

For more sophisticated uses of the AMMC device, the decoder program will be a rolling decoder. This means that the content will be compressed with a unique format. The format is changed from one content to another.

Consequently, only the particular decoder program that is loaded on the card can be used to decompress the content. Therefore, each compression format constitutes an encryption method and the decoder program constitutes the key. This is implemented by interchanging data fields within the compressed data in a random or approximately random pattern specified a key which is used by the decoder program to place data fields in the correct order. This is particularly useful for AMMC devices used to transport highly sensitive, confidential and secret information. Government documents and medical files are but two examples of such information that can usefully be transported between users using the AMMC devices.

Yet another aspect of the present invention that allows protection of content is the use of systematically or randomly encrypted occasional bytes. This is useful because encryption of all content, decoder, or controller software takes lots of processor power, as does de-encryption. For example, if video content is encrypted, the processor power required for decoding is significant. The present invention consists of encrypting only occasional pieces of the AMMC device content that the decoder and or CPS code recognizes (hidden message) in order to play the following frame / short audio/video sequence correctly.

DETAILED DESCRIPTION

These aforementioned encryption and / or digital rights methods can be used in combination or alone.

The well known Sissler Video Correction Fully Automatic Encoding Algorithm (SVCFAEA) takes the raw video and makes it easier to encode. With SVCFAEA, if there is not enough power in the computer to process the video playback at full frame speed, then the video content is modified

so it visually looks the same and yet takes less memory and can be decoded at visually pleasing speeds. In the present invention, the SVCFAEA algorithm is used to modify the AMMC device content to be loaded on the AMMC device by using a series of varying filters. These filters are applied by measurement of the amount of quantitization in the content to keep. This process is designed to reduce the data rate required of the decoder such that frames are not dropped by the decoder during the decoding operation. The SVCFAEA process is particularly useful as it is an automated manufacturing process as opposed to a manual process. This reduces the cost of manufacture of AMMC device content.

AMMC ARCHITECTURE

To provide a further understanding of the way the AMMC is used, the following AMMC architecture is described. The AMMC is partially formatted using a FAT (file allocation table) format per the standard for an MMC card. Using this file format, a directory is made and named for the host device on which the card will run, such as PocketPC 2577. This directory contains an autoloading program. The autoloading program performs initialization, verifies manufacturer code, verifies desired read/write capabilities and initiates the launcher program. The launcher program provides a user interface for selecting audio/video content to be played. Selection of content determines the type of player decoder program or other application required to play the content. Player programs and content data are stored on the card using a file system that is not standard.

MMC devices today typically can be written to multiple times before they will fail. In a "write once" card, a controller circuit within the card

restricts the writing to one time only. In a masked memory card, the data is etched into the memory at the manufacturing site and write circuitry is not provided. .

Where a write once controller circuit is used, the controller circuit restricts the writing to only once. There are controller circuits that count the write cycles and limit them to a particular number. MMC cards of this class are utilized in the present invention.

In contrast, as an example, with today's flash memory, you can write many times, almost without limit, and the controller circuit allows this functionality. Out of every batch of flash memory that should be written to 10,000's of times there is defective memory produced that can be written to only 1000 times or less. This memory is typically considered defective. Today it is usually thrown away. As such it is available at a lower cost than the fully capable memory. A preferred embodiment of the present invention uses these flash memory cards to reduce cost. In this case, the controller circuit is implemented as a processor with a program and the program is adjusted to limit the number of times that the AMMC device can be written.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

There is a new MMC card with a controller circuit that allows us to do what is described above. It causes the card to act like a read-write flash memory, but it will only allow a write when so directed by the "owner". Instead of OTP (one time programmable) or MTP (multi time programmable), the controller program is set for a FTP (few time programmable) only write-able by the factory, not at the PDA or consumer level.

Here is an example of how to implement one embodiment:

Assess application to determine type of MMCE card: MTP, Flash, SD or MMC.

Select a permutation of the rolling decoder.

Obtain audio/video in digital form accessible to a PC workstation.

Preprocess the Video to acceptable dimensions. Nominally this would be 240 lines by 320 pixels. Reduce the frame rate to one half of the original with a target of 12, 12.5 or 15 frames per second.

Assess the complexity of the video with respect to both intra frame detail and inter frame motion.

Perform frame by frame filtering where deemed appropriate.

Adjust brightness by:
Computing the histogram of the luma pixels.
Adding sufficient bias to each pixel such that no more than 5% of all luma pixels are above a nominal saturation level.

Encode the audio/video sequence with rate control imposed.
Record the average required quantization levels.
Ascertain time periods of heavy quantization (combining of individual data items into fewer data items to reduce heavy decoding requirements).
These will be candidate areas for further filtering.

Transfer the encoded data to a test card with an embedded AMMC player program.

Using a PocketPC, play the video. Monitor the complete video, paying particular attention to the heavily quantized areas, brightness saturation and audio quality.

Readjust parameters and repeat the coding/testing process from above.

Here is an example of how to implement an embodiment:

A user of video entertainment places the AMMC card into the slot provided for MMC cards on a Dell PDA. The Dell PDA then displays on its screen a menu of content items on the AMMC card to the user. The entertainment user then selects the desired entertainment content for playback and the selection process, typically tapping on the PDA screen, initiates the playback sequence of the selected content, in this case a video clip. According to the methods described above, the Dell PDA will only play the content when it is read from authentic AMMC cards, not from other flash MMC cards or other storage devices available to the PDA/ Cell phone.

A media layer program that can work with various operating systems must be on-board the card in order to accommodate a single card playing on various devices with various operating systems. The Dell PDA in this case is only an example. For instance, the player program can operate on various platforms/O/S's. The player program is operational on 200 MHz StrongArm processors and 300/400 MHz XScale Intel chips which show compute performance nearly identical to that of StrongArm. The player program is also applicable to TI's new OMAP processors operating at 175 MHz with DSP coprocessor's.

The player program running on the Dell PDA verifies the READONLY status of the card by attempting to rename or delete an existing file on the card (this insures that the card is in fact READONLY and not just a full flash card). For Flash, the player program ensures data and player program are both present and verifies that the manufacturer's code on the card is correct. The player program will not play content if these criteria are not met. The player program always verifies manufacturer's ID on the memory card. If incorrect, the player program exits. The player program only successfully runs if the AMMC card remains inserted in the PDA/ Cell phone. The EAMMC P exits (stops execution of the program) whenever the AMMC card is absent or removed.

A typical user cannot use content copied from an AMMC card to an MMC Flash card or an SD card, even when the read-only tab is set to the enabled position. The content is keyed to the player program on the same AMMC card. The player program will fail to recognize content from another AMMC product release. This is because each player program contains a decoder tuned specifically to the content of each specific AMMC. Content data formats are not standard.

This encryption is thus a multi-level multi-key encryption (Rolling Decoder Feature) comprising a 1st level "soft" encryption that is done to all bits of digital content and a 2nd level "hard" encryption done to selected portions of the file (e.g. video key-frames). This method reduces the CPU overhead and lowers the impact of decryption on playback efficiency. This method further makes a user's playback of any straight (undecrypted) content undesirable because such an attempt at playback without the rolling decoder feature will have a lower quality than playback with a rolling decoder feature. Such attempts by a user to playback content without the rolling decoder player program will exhibit the

undesirable playback effects of breaks in audio, unrecognizable video images, player program stops and crashes.

Rather than use a single key, a set of keys is used to encrypt/decrypt each content file. An algorithm is used to select the correct key from the set at any given time. Further, using multiple keys increases the difficulty in reverse engineering the encryption algorithm.

Another benefit of this on-the-fly decryption is that the entire file is never decrypted at once into memory and can thus not be copied easily by a user into another unencrypted file for subsequent non-encrypted playback.

The rolling encoder/decrypter is separate from 128-bit encryption and watermarking technologies already developed and in the public domain and which may also be utilized. To illustrate, the decoder for video "A" on one card production run would not decode the video on the video "B" card run even assuming that the encryption was broken. This is because the key set and/or encryption technique and content encoder algorithm are changeable for each released card product. This is possible since each product is shipped with a matching player program in binary form on the same card. This technique reduces the impact of unauthorized acquisition or discovery of a previous card's key set or content encoder algorithm.

Both Secure Digital (S/D) and Multimedia (MMC) card formats fit into the same slot on handheld devices. This is the same slot that is used by the AMMC cards. Secure Digital (S/D), Multimedia (MMC), and Advanced Multimedia (AMMC) comply with SDMI content protection strategies relative to the card itself and the AMMC card is SDMI certifiable by MMCA.org, and SDcard.org

Yet another example of how to implement another embodiment is:

A user of game entertainment places the AMMC card into the slot provided for MMC cards on a Dell PDA. The Dell PDA then displays on its screen the menu of game content items on the AMMC card to the user. The game user then selects the desired game he or she wants to play for playback and the selection process, typically tapping on the PDA screen, initiates the playback sequence of the selected game, which might be a full range video game. The Dell PDA will only play games published on AMMC cards from authentic AMMC cards, not from other flash MMC cards or other storage devices available to the PDA/ Cell phone.

The game can be played on the PDA by a game user interacting individually with the PDA device. However, the game user can also use the wireless or wired options of the PDA or Cell phone device to communicated his or her game interactions to other game users/players. In the same manner that Mutiple-User Internet games are played today, the games on AMMC cards can also be used and played by multiple PDA/Cell phone game users playing synchronously or sequentially over the Internet or other network.

While various exemplary and preferred embodiments of the invention have been illustrated and described above, it will be apparent to those skilled in the art, in light of this disclosure, that variations and modifications can be made without departing from the true spirit of the invention. All such variations and modifications are intended to be included within the scope of the appended claims.

Claims
We claim:

1. A solid state memory card where information stored within the memory comprises a solid state memory card decoder program and content for presentation to a human coded in a format suitable for decoding by the decoder program.

2. The Solid state memory card of claim 1 wherein the content is one or more video games.
3. The solid state memory card of claim 1 wherein the content is one or more video movies.
4. The solid state memory card of claim 1 wherein the content is one or more audio tracks.

5. The solid state memory card of claim 1 wherein the content file is additionally encrypted.
6. The solid state memory card of claim 1 wherein the decoder file may be additionally encrypted.
7. The solid state memory card of claim 1 wherein the decoder file is a rolling decoder.

8. A solid state memory card where information stored within the memory comprises a solid state memory card decoder program, content for presentation to a human coded in a format suitable for decoding by the decoder program, and content protection software.

9. A flash memory card that has been tested to estimate the number of write cycles that it can accommodate and the estimate is fewer than 1000 containing a controller that allows only a limited number of write operations to the memory card.

10. A process of using a solid state memory card wherein the solid state memory card is reused after a first loading of content by returning the solid state memory cards for reprocessing and reloading with a second loading of content and decoder.

11. A process of using a solid state memory card wherein the solid state memory card is reused after a second loading of content by returning the solid state memory card for reprocessing and reloading with a third or more loading of content and decoder.

* * * * *